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TITLE

**A TRANSMISSION AND/OR RECEPTION DEVICE FOR MOUNTING TO  
A VEHICLE WHEEL AND HOUSING FOR SAME**

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a transmission and/or reception device for mounting to a vehicle wheel, and also to a housing for such a device.

Related Art

[0002] Car manufacturers are tending to fit the wheels or tires of vehicles with devices that serve to provide information about the tires to a vehicle computer. Such devices include, for example, pressure sensors, temperature sensors, and devices for identifying tires. These tire information devices are coupled to transmission and/or reception devices.

[0003] It is known to make use of radio technology to enable the device to communicate with a computer. The same technology can also be used for transmitting energy to the device from a fixed point of the vehicle. To this end, a fixed antenna is provided on the vehicle. It is connected by electric cables to the computer and/or to an electrical power supply. The transmission and/or reception device associated with the tire information device is also connected to an antenna which is carried by the wheel or the tire.

[0004] Such communications technology raises the problem that the active area necessary for proper operation of the antenna requires the antenna to be rather large. Unfortunately, the transmission and/or reception device is generally integrated with the sensor in a common housing, which is miniaturized as much as possible, for reasons of weight and to avoid interfering with fitting the tire on the wheel. As a result, it is necessary to make use of an external antenna that is separate from the housing. This leads to several drawbacks relating to, for example, manufacturing costs, stock management, assembly difficulties, reliability, and overall weight.

#### SUMMARY OF THE INVENTION

[0005] The present invention seeks to provide a transmission and/or reception device that does not require an antenna that is separate from the housing.

[0006] The present invention provides a transmission and/or reception device for mounting on a wheel of a vehicle, the device comprising a housing and being characterized in that it includes an antenna carried on an outside face of the housing, the antenna including a cable which is wound around the housing. The section of the housing forms a solenoid, thereby constituting an antenna that is particularly suitable for the intended application. In particular, it is preferable for the housing to be shaped in such a manner as to be positioned on the wheel so that the orientation of the solenoid is parallel to an ortho-radial axis of the wheel, i.e., an axis that is at right angles to a radius and to the axis of the wheel.

[0007] The device of the invention takes advantage of the presence of a housing which, even though small in volume, nevertheless provides a section of non-negligible area, suitable for providing an area that is sufficient for the antenna.

[0008] In a particular embodiment, the outside face of the housing is shaped to protect the antenna. This protection is of use particularly while a tire is being mounted on the wheel, during which operation the bead of the tire slides in the assembly groove during inflation and rubs against the housing engaged in a corner of the groove. In a particular embodiment, the outside face of the housing has grooves suitable for receiving the cable. Such grooves can participate both in positioning and in protecting the cable.

[0009] In one aspect, the present invention provides a transmission and/or reception device for mounting on a wheel of a vehicle. The device includes a tire information device configured to provide information relating to a tire. A transmitter/receiver is electrically connected to the tire information device. An antenna is electrically connected to the transmitter/receiver for transmitting and/or receiving radio frequency signals. The device further includes a housing configured to house the tire information device and the transmitter/receiver. The antenna is formed by a cable wound around an outside face of the housing.

[0010] In another aspect, the present invention provides a housing for a transmission and/or reception device configured to be mounted to a vehicle wheel. The transmission and/or reception device including an antenna. The housing has an interior portion for housing the transmission and/or reception device and an outside face shaped to support a cable forming the antenna. The outside face is shaped to support a cable wrapped around the housing in a solenoidal arrangement.

[0011] Embodiments of the present invention may include one or more of the following features.

[0012] The tire information device may include a pressure sensor for measuring the pressure inside a tire mounted on the wheel.

[0013] As noted above, the outside face of the housing may be shaped to protect the antenna, and the housing may be shaped to be positioned on the wheel in such a manner that the wound cable forms a solenoid that is oriented along an ortho-radial axis of the wheel. The outside face of the housing may include grooves configured to receive the cable. The grooves may be shaped to receive the cable fully, in such a manner that the cable is protected by the ridges between the grooves against possible contact. The grooves may be formed by spaces between ribs formed on the outside face of the housing.

[0014] The device may include an outer protective film covering the antenna formed on the outside face of the housing. The film may be formed of a heat-shrink plastic material, such as polyethylene or polytetrafluoroethylene (PTFE). The film may be formed of polypropylene, polyphenylene sulphide (PPS), or polyamide.

[0015] An outside protecting layer may be molded onto the antenna formed on the outside face of the housing. The molded outside protective layer may be formed of the same material as the housing. The molded outside protective layer may be obtained by injection molding a thermosetting material, such as epoxy resin, phenolic resin, polycarbonate, polyurethane, polyamide, vinyl ester, or polyester. The molded outside protective layer may be formed of polyphthalamide (PPA).

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The invention will be better understood on reading the following description, given purely by way of example, and made with reference to the drawings, in which:

Figure 1 is a diagram of the front of a vehicle seen from the side and provided with a device in accordance with the present invention;

Figure 2 is a detailed diagram of the device shown in Figure 1;

Figure 3 is an axial section diagram of a wheel of the vehicle shown in Figure 1, provided with a device in accordance with the present invention;

Figure 4 is a radial section diagram of the wheel shown in Figure 3; and

Figure 5 is a detailed diagram in longitudinal section of the device shown in Figure 2.

#### DETAILED DESCRIPTION OF THE EMBODIMENT

[0017] Figure 1 shows the front of a vehicle, given overall reference 10. The vehicle 10, which is a car in the example shown, has mounted assemblies, each having a wheel 14 carrying a tire 16, with only the front-right assembly 12 being shown. When mounted on the car 10, the assembly 12 is located in a wheel arch 18.

[0018] The vehicle has an antenna 20 situated in the vicinity of the wheel arch 18 and designed to interact with a device 22 carried by the wheel 14. The device 22, which is shown in detail in Figure 2, comprises a pressure sensor 24 coupled to a transmission and/or reception device 26. The transmission and/or reception

device 26 comprises electronic transmitter/receiver 28 together with an antenna 30.

[0019] The pressure sensor 24 and the electronic transmitter/receiver 28 are integrated in a housing 22 having an outside face 34 that supports the antenna 30. The housing 22 is of elongate, prismatic shape and is fixed in an assembly groove of the wheel 14, so that its long dimension extends substantially along an ortho-radial axis of the wheel 14, as can be seen in Figures 3 and 4, i.e., an axis that is at right angles to a radius and to the axis of the wheel.

[0020] The antenna 30 comprises a cable 36, for example made of copper, which is wound around the housing 22 so as to form a solenoid. When the device 26 is mounted on the wheel 14, the solenoid is oriented along an ortho-radial axis of the wheel 14.

[0021] In order to protect the cable 36 while the tire is being mounted on the wheel, the outside face 34 of the housing includes grooves 38, as shown in Figure 5. The grooves 38 are formed by spaces left empty between ribs 40 formed on the outside face 34 of the housing 22. The grooves 38 are shaped to receive the cable 36 fully, so that the cable is protected by the ribs 40 between the grooves 38 against possible contact. To further improve protection of the cable 36, an outer protective film 42 of heat-shrink material covers the outside face 34 of the housing 22.

[0022] Alternatively, the protection of the loops of the antenna 30 can be obtained by molding, for example by injection molding, of the assembly housing 22 and antenna 30. The material constitutive of the molded layer may be identical to the material of the housing.